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## NOTE

### NATIONAL SECURITY PROTECTION: THE CRITICAL TECHNOLOGIES APPROACH TO U.S. EXPORT CONTROL OF HIGH-LEVEL TECHNOLOGY

#### I. INTRODUCTION

Throughout history, governments have imposed export controls on goods and technologies for a variety of reasons, including national security,<sup>1</sup> while at the same time they have promoted export trade to enhance their countries' economies.<sup>2</sup> Problems have arisen when exports are promoted at the expense of national security. The United States has tried to reconcile this conflict by developing a new approach to export controls—the critical technologies approach.

The United States has traditionally exercised tight export controls in wartime; it did not impose peacetime export controls until 1949. In that year the United States imposed strict export controls on trade with communist countries.<sup>3</sup> The U.S. policy of restricting exports to communist countries, with an emphasis on control of goods rather than technologies, continued into the 1960's,<sup>4</sup> when the U.S. export policy shifted to an emphasis on export promotion instead of export control. This policy change was embodied in the Export Administration Act of 1969<sup>5</sup> and its subsequent amendments,<sup>6</sup> which further relaxed export controls.

1. Other reasons for export controls are the furthering of foreign policy and the protection of commodities in short supply. An excellent evaluation of problems with export controls is Berman & Garson, *United States Export Controls—Past, Present and Future*, 67 COLUM. L. REV. 791 (1967) [hereinafter cited as Berman & Garson]. A more recent work on export controls is a symposium of student notes addressing topics such as controls for human rights purposes and for national security protection. 9 GA. J. INT'L & COMP. L. 237 (1979).

2. See generally *Export Administration Act: Agenda for Reform: Hearings Before the Subcomm. on Int'l Economic Policy and Trade of the House Comm. on Int'l Relations*, 95th Cong., 2d Sess. (1978); *Export Policy, Part 3, Foreign Government Policies and Programs to Support Exports: Hearing before the Subcomm. on Int'l Finance of the Senate Comm. on Banking, Housing, and Urban Affairs*, 95th Cong., 2d Sess. (1978).

3. Export Control Act of 1949, 63 Stat. 7 (1949) (codified at 50 U.S.C. §§ 2021-32 (1964) (expired 1969) [hereinafter cited as ECA of 1949].

4. See generally Note, *U.S. Technology Transfers to the Soviet Union and the Protection of National Security*, 11 L. & Pol'y Int'l Bus. 1037-46 (1979) [hereinafter cited as *U.S. Technology Transfers*].

5. Export Administration Act of 1969, 83 Stat. 841 (codified at 50 U.S.C. §§ 2401-13 (1976) (expired 1979) (current version at 50 U.S.C. §§ 2401-13 (Supp. 1980)) [hereinafter cited as EAA of 1969].

6. Substantive amendments to the EAA of 1969 were passed in 1974 and 1977. EAA Amendments of 1974, Pub. L. No. 93-500, 88 Stat. 287 (amending scattered sections of 50 U.S.C. app. § 2401 (1976) and EAA Amendments of 1977, Pub. L. No. 95-52, 91 Stat. 235 (amending scattered sections of 50 U.S.C. app. §§ 2401-13 (1976)) [hereinafter cited as 1977 Amendments].

In recent years there has been a growing awareness that export promotion may strengthen the military capabilities of potential adversaries and endanger the national security of the United States. Most threatening is the export of technology because the recipient acquires the ability to obtain the end-product without further reliance on the United States.<sup>7</sup> In 1977, the Department of Defense (DOD) adopted an approach to export control that focused on control of technologies that were militarily critical.<sup>8</sup> Congress endorsed the critical technologies approach to export controls for national security purposes in the Export Administration Act of 1979.<sup>9</sup> As required by that Act, the DOD is now developing a "Militarily Critical Technologies List,"<sup>10</sup> identifying militarily significant<sup>11</sup> goods and technologies that should not be exported to potential adversaries.

This Note focuses on the use of the critical technologies approach to control exports for national security. First, it examines the history and the policies that led to the development of the critical technologies approach. Second, several export cases and an examination of computer

7. Technology has been defined as "know-how—ways of designing, manufacturing, or utilizing things." Technology transfer has been defined as the "act of conveying know-how from one country to another." *International Transfer of Technology*, 4 WEEKLY COMP. OF PRES. DOC. 1471 (Aug. 28, 1978) [hereinafter cited as *International Transfer of Technology*].

8. Memorandum from Harold Brown, Secretary of Defense, to the Secretaries of the Military Departments (Aug. 26, 1977) [hereinafter cited as 1977 DOD Interim Policy Statement] reprinted in *Transfer of Technology and the Dresser Industries Export Licensing Actions: Hearing Before the Permanent Subcomm. on Investigations of the Senate Comm. on Governmental Affairs*, 95th Cong., 2d Sess. 90-92 (1978). The Department of Defense described critical technology as

classified and unclassified nuclear and non-nuclear unpublished technical data, whose acquisition by a potential adversary could make a significant contribution, which would prove detrimental to the national security of the United States, to the military potential of such country—irrespective of whether such technology is acquired directly from the United States or indirectly through another recipient, or whether the declared intended end-use by the recipient is a military or non-military use.

*Id.* at 90-91. A summary evaluation of the policy statement appears in Robertson, *Defense Secretary Moves to Stiffen Export Curbs*, 22 ELECTRONIC NEWS 14 (Sept. 5, 1977).

9. Export Administration Act of 1979, 50 U.S.C. app. §§ 2401-13 (Supp. 1980) [hereinafter cited as EAA of 1979].

10. 45 Fed. Reg. 65,014 (1980).

11. The Department of Defense has interpreted "militarily significant" to mean "increases in war fighting capability, mission enhancement, provision of new capabilities or a combination of these that could change the military balance. We consider technologies and goods contributing to the industrial base supporting military manufacture to be on the list of significant items." *Transfer of Technology to the Soviet Bloc: Hearing Before the Permanent Subcomm. on Investigations of the Senate Comm. on Governmental Affairs*, 96th Cong., 2d Sess. 51 (1980) [hereinafter cited as 1980 Senate Governmental Affairs Hearings]. The initial report on which much of the current export control philosophy for national security purposes is based is Defense Science Board Task Force on Export of U.S. Technology, *An Analysis of Export Control of U.S. Technology—A DOD Perspective* (1976) [hereinafter cited as Bucy Report] reprinted in *Transfer of Technology and the Dresser Industries Export Licensing Actions: Hearing Before the Permanent Subcomm. on Investigations of the Senate Comm. on Governmental Affairs*, 95th Cong., 2d Sess. 33-89 (1978) [hereinafter cited as 1978 Senate Hearings].

software export problems are used to illustrate export licensing decisions and the application of the militarily critical technologies list. Finally, the Note analyzes the critical technologies theory and practice and its effectiveness in achieving both the national security goals and the trade promotion goals of U.S. export policy.

## II. USE OF EXPORT CONTROLS TO PROTECT NATIONAL SECURITY

In response to the cold war era of the 1940's and 1950's, the United States applied export controls similar to those used during World War II<sup>12</sup> to exports to the Soviet Union and its satellite countries. The Export Control Act of 1949 authorized the President to "prohibit or curtail the exportation from the United States, its Territories, and possessions, of any articles, materials, or supplies, including technical data . . .," as was deemed necessary to protect domestic supplies, to further foreign policy, and to protect national security.<sup>13</sup> The export controls were implemented by the Department of Commerce (Commerce) through the Office of Export Control, and the Office of Export Control was advised by interdepartmental committees with DOD participation. The ultimate decisions were subject to the control of the President.<sup>14</sup> The Export Control Act resulted in a virtual embargo on the export of all military and industrial goods, and even many consumer goods, to com-

12. The Trading with the Enemy Act of 1917, ch. 106, 40 Stat. 411 (1917) (current version at 12 U.S.C. § 95a (1980) and 50 U.S.C. §§ 1-39 (1980)), stated the following in section 3:

That it shall be unlawful—

(a) For any person in the United States, except with the license of the President, . . . to trade, or attempt to trade, either directly or indirectly, with, to or from, or for, or on account of, or on behalf of, or for the benefit of, any other person, with knowledge or reasonable cause to believe that such other person is an enemy or ally of enemy, or is conducting or taking part in such trade, directly or indirectly, for, or on account of, or on behalf of, or for the benefit of, an enemy or ally of enemy.

Short supply export controls were used during World War II to assure that supplies of essential goods were not exported, which could have exacerbated existing shortages in the United States. DEPT. OF COMMERCE, REPORT OF THE PRESIDENT ON EXPORT PROMOTION FUNCTIONS AND POTENTIAL EXPORT DISINCENTIVES 7-1 (1980) [hereinafter cited as PRESIDENT'S 1980 EXPORT REPORT].

13. ECA of 1949, *supra* note 3, at §§ 2022-23. The Act gave the President almost limitless power to control exports:

Sec. 3. (a) To effectuate the policies [of protecting short supplies, furthering foreign policy, and protecting national security] set forth in section 2 hereof, the President may prohibit or curtail the exportation from the United States, its Territories, and possessions, of any articles, materials, or supplies, including technical data, except under such rules and regulations as he shall prescribe. To the extent necessary to achieve effective enforcement of this Act, such rules and regulations may apply to the financing, transporting, and other servicing of exports and the participation therein by any person.

14. Berman & Garson, *supra* note 1, at 806-07. The Act gave the President delegation power: "The President may delegate the power, authority, and discretion conferred upon him by this Act to such departments, agencies, or officials of the Government as he may deem appropriate." ECA of 1949, *supra* note 3, at § 2023(b).

munist countries.<sup>15</sup> Recognizing the futility of imposing unilateral export controls, the United States and six of its allies formed an informal Consultative Group on Export Controls in 1949.<sup>16</sup> The following year a Coordinating Committee (CoCom) of the Consultative Group was formed to develop, review, and update secret lists of goods embargoed from export to communist countries by the CoCom countries.<sup>17</sup> Those goods banned were "of strategic military value to all the Communist powers."<sup>18</sup> Because the organization was informal and voluntary, each member nation was responsible for implementing the CoCom export controls through domestic legislation.<sup>19</sup> The creation of CoCom did not require new export controls to be developed in the United States, as the existing U.S. controls were stricter and more extensive than those of CoCom. Rather, CoCom required member approval of exports of goods on the CoCom lists on a case-by-case basis.<sup>20</sup>

In 1951, the United States enacted the Mutual Defense Assistance Act,<sup>21</sup> commonly known as the Battle Act, to ensure that other member

15. Bingham & Johnson, *A Rational Approach to Export Controls*, 57 FOREIGN AFF. 894, 896 (1979).

16. Berman & Garson, *supra* note 1, at 834-35.

17. *Id.* at 835. The CoCom control list has not yet been published. U.S. DEPT OF COMMERCE, 121 EXPORT AD. REP. 30 (1979-80) [hereinafter cited as EXPORT AD. REP.], even though the EAA of 1979 requires the President to negotiate with the other CoCom members for publication of the list. EAA of 1979, *supra* note 9, at § 2404(i).

18. AMERICAN ENTERPRISE INSTITUTE, PROPOSALS FOR REFORM OF EXPORT CONTROLS FOR ADVANCED TECHNOLOGY 4 (1979) [hereinafter cited as AEI PROPOSALS] (quoting Templeman, *The Crumbling Controls on Trading with Communists*, BUS. WEEK, June 18, 1975, at 75).

19. Note, *Export Licensing: Uncoordinated Trade Repression*, 9 GA. J. INT'L & COMP. L. 333, 335 (1979). Today CoCom continues to function as an informal trade coordination organization, EXPORT AD. REP., *supra* note 17, at 44, even though the Consultative Group no longer exists. When France withdrew from the military wing of the North Atlantic Treaty Organization (NATO) and refused to appoint a new chairman for the Consultative Group, the group ceased to function. AEI PROPOSALS, *supra* note 18, at 5. The current member nations are Japan and all remaining members of NATO except for Iceland. EXPORT AD. REP., *supra* note 17, at 44.

20. Berman & Garson, *supra* note 1, at 836 n.182.

21. The Mutual Defense Assistance Act of 1951, 65 Stat. 644 (1951) (codified at 22 U.S.C. §§ 1611-13d (1976) (superseded by the EAA of 1979, *supra* note 9, at § 2416) [hereinafter cited as the Battle Act]. The act subjects the following items to embargo:

arms, ammunition, and implements of war, atomic energy materials, petroleum, transportation materials of strategic value, and those items of primary strategic significance used in the production of arms, ammunition and implements of war which should be embargoed to effectuate the purposes of this chapter. . . .

*Id.* at § 1611b(a). The act further stipulates that

[all] military, economic, or financial assistance to any nation shall, upon the recommendation of the Administrator, be terminated forthwith if such nation after sixty days from the date of a determination under subsection (a) of this section knowingly permits the shipment to any nation or combination of nations threatening the security of the United States, including the Union of Soviet Socialist Republics and all countries under its domination, of any item which he has determined under subsection (a) of this section after a full and complete investigation to be included in any of the following categories: Arms, ammunition, and implements of war, atomic energy materials, petroleum, transportation

nations complied with the CoCom controls, although the coverage of the Battle Act was broader than just the CoCom nations. Under the Battle Act the United States denied all aid to any nation that allowed strategic materials to be shipped to a communist country.<sup>22</sup> Goods that originated in the exporting nation, as well as those goods that were reexported from or transshipped through those nations, were subject to the Battle Act's provisions.<sup>23</sup> In 1951, the United States had the leverage over other free world countries needed to make the Battle Act effective. With the economic recovery of the western world, however, and its acquisition of strategic goods and technologies previously possessed only by the United States, America lost its ability to control the export policies of other western nations.<sup>24</sup> Faced with the need to export to maintain economic viability, the western nations pressured the United States to reduce the CoCom controls.<sup>25</sup> In addition, the military-industrial development of the Soviet Union indicated that the embargo by the United States and CoCom was ineffective in preventing the acquisition of technology and arms by the Soviet Union.<sup>26</sup> In response to these factors, the CoCom list was first reduced in 1954, when non-military goods were removed from the list.<sup>27</sup>

The United States, however, continued to direct its domestic export controls at limiting Soviet expansion.<sup>28</sup> In 1962, the Export Control Act

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materials of strategic value, and items of primary strategic significance used in the production of arms, ammunition, and implements of war. *Provided*, that the President after receiving the advice of the Administrator and after taking into account the contribution of such country to the mutual security of the free world, the importance of such assistance to the security of the United States, the strategic importance of imports received from countries of the Soviet bloc, and the adequacy of such country's controls over the export to the Soviet bloc of items of strategic importance, may direct the continuance of such assistance to a country which permits shipments of items other than arms, ammunition, implements of war, and atomic energy materials when unusual circumstances indicate that the cessation of aid would clearly be detrimental to the security of the United States

*Id.* at § 1611b(b).

22. *Id.* at § 1611.

23. Procedures for regulating reexport were developed within CoCom and applied by the United States in enforcing the Battle Act, *Id.* at §§ 1611-13d for example, the Import Certificate-Delivery Verification (IC/DV) procedure subjects a foreign importer to enforcement of United States export violation penalties by the importer's own government. Berman & Garson, *supra* note 1, at 817, 839. The terms "reexport" and "transshipment" are used interchangeably in the literature.

24. AEI PROPOSALS, *supra* note 18, at 5.

25. Berman & Garson, *supra* note 1, at 841.

26. *Extension and Revision of the Export Administration Act of 1969: Hearings and Markup Before the Subcomm. on Int'l Economic Policy and Trade of the House Comm. on Foreign Affairs, Part 1*, 95th Cong., 1st Sess. 18 (1979) (statement of George W. Ball) [hereinafter cited as *1979 House Foreign Affairs Hearings and Markup*].

27. *U.S. Technology Transfers*, *supra* note 4, at 1046 n.56.

28. *See generally* Berman & Garson, *supra* note 1, at 799-800.



was amended to require the President to deny an export license for a good that "makes a significant contribution to the military or economic potential of any nation" where such export "would prove detrimental to the national security and welfare of the United States."<sup>29</sup> Export restrictions on commercial as well as military goods were based, in part, on the theory that development of the Soviet industrial base through U.S. exports of non-military goods would have an adverse impact on the United States' national security.<sup>30</sup> The economic potential factor was only one of many changes in the export control system that contributed to its increasing complexity.<sup>31</sup> The growing number of control lists an exporter had to consult before deciding whether to export,<sup>32</sup> prompted the Department of Commerce to publish a Commodity Control List (CCL) in January 1965.<sup>33</sup> The CCL, a comprehensive list of export commodities for which Commerce had responsibility, represented one of the early steps the United States took toward facilitating exports.<sup>34</sup>

By 1969, however, U.S. foreign policy had changed. In that year foreign policy was characterized by the Strategic Arms Limitation Talks (SALT) and progress toward detente with the Soviet Union.<sup>35</sup> In this spirit of cooperation, the number of United States-Soviet Union economic and cultural exchange agreements, including agreements on scientific and technological exchange, multiplied.<sup>36</sup> With the expiration in 1969 of the 1949 Export Control Act, Congress enacted the Export Administration Act of 1969 (EAA of 1969).<sup>37</sup> This act reflected a new direction in U.S. policy, one favoring East-West trade while still recognizing the need to protect national security and further foreign

29. Export Control Amendments of 1962, § 4, 76 Stat. 127 (1962) (codified at 50 U.S.C. § 2023 (1964)) (expired 1969) (emphasis added).

30. Berman & Garson, *supra* note 1, at 801. The addition of the economic potential factor did not represent a change in export policy, but only a Congressional recognition of the existing export situation. *Id.* at 800-01.

31. *Id.* at 820.

32. *Id.*

33. *Id.*

34. *See generally id.* at 820-23.

35. Numerous references to United States-Soviet Union attempts at détente are available. C. TIMBERLAKE, DÉTENTE: A DOCUMENTARY RECORD (1978); AMERICAN BAR ASSOCIATION, DÉTENTE (1977); J. SIMON, RULING COMMUNIST PARTIES AND DÉTENTE: A DOCUMENTARY HISTORY (1975).

36. *See generally* NATIONAL ACADEMY OF SCIENCES, REVIEW OF THE U.S./U.S.S.R. AGREEMENT ON COOPERATION IN THE FIELDS OF SCIENCE AND TECHNOLOGY (1977); REVIEW OF U.S./U.S.S.R. INTERACADEMY EXCHANGES AND RELATIONS (1977) [hereinafter cited as 1978 House Science & Technology Hearings] reprinted in *Key Issues in U.S.-U.S.S.R. Scientific Exchanges and Technology Transfers: Hearings Before the Subcomm. on Domestic and Int'l Scientific Planning, Analysis and Cooperation of the House Comm. on Science & Technology*, 95th Cong., 2d Sess. 428-59, 460-504 (1978).

37. EAA of 1969, *supra* note 5.

policy objectives.<sup>38</sup> The President was no longer required to consider the "economic potential" of an export,<sup>39</sup> but was instead given broad discretion to impose export controls for foreign policy reasons or to impose controls on "any articles, materials, or supplies, including technical data or any other information," where necessary to achieve the goals of the EAA of 1969.<sup>40</sup> The rationale for increased trade with the East, particularly the Soviet Union, included the following considerations:

1. the economic recovery of Western Europe and strengthened West European security in relation to the Communist countries;
2. growth in the economic strength of Eastern Europe and its confidence in its security vis-a-vis the West;
3. a shattering of the appearance and reality of world unity among the Communist countries; and
4. a decline in the rigid ideological assumptions held by the East and the West concerning each other, coupled with corresponding adjustments of conduct.<sup>41</sup>

In 1977, amendments<sup>42</sup> to the EAA of 1969 further relaxed export controls, providing in part that the basis for an export licensing decision should be the relationship between the recipient country and the United States and its allies, rather than the recipient country's form of government.<sup>43</sup> More importantly, for the first time, export license approval was mandated for goods that were "available without restriction from sources outside the United States in significant quantities and comparable in quality to those which would be subject to [export] controls" unless the President determined that the export would be detrimental to U.S. national security.<sup>44</sup>

Following the passage of the EAA of 1969 and its subsequent amendments, East-West exchanges of scientific and technological information<sup>45</sup> and trade activity<sup>46</sup> increased markedly. DOD experts stated that

38. *Id.* at § 2402(1).

39. *U.S. Technology Transfers*, *supra* note 4, at 1048. The President was required to keep the business community informed about changes in export control policy. EAA of 1969, *supra* note 5, at § 2403(a)(2).

40. EAA of 1969, *supra*, note 5, at § 2403(b)(1).

41. McQuade, *U.S. Trade With Eastern Europe: Its Prospects and Parameters*, 3 L. & POL'Y INT'L BUS. 43 (1971).

42. 1977 Amendments, *supra* note 6.

43. *Id.* at § 2403(b)(2)(A). The language of the EAA of 1969 was amended to read as follows: In administering export controls for national security purposes . . . United States policy toward individual countries shall not be determined exclusively on the basis of a country's Communist or non-Communist status but shall take into account such factors as the country's present and potential relationship to the United States, its present and potential relationship to countries friendly or hostile to the United States, its ability and willingness to control retransfers of United States exports in accordance with United States policy, and such other factors as the President may deem appropriate.

*See generally* H.R. REP. NO. 190, 95th Cong., 1st Sess. (1977).

44. 1977 Amendments, *supra* note 6, at § 2403(b)(2)(B).

45. *See, e.g.*, 1978 House Science & Technology Hearings, *supra* note 36.



although the amount of high technology exports from the United States to the Soviet Union was still rather small, those exports had significantly increased the "effectiveness and efficiency" of Soviet programs.<sup>47</sup> Furthermore, and more significant than the increase in total quantity of exchange, there was a shift in content of the exports from primarily agricultural products and basic manufactured goods to high technology goods, processes, and turnkey projects.<sup>48</sup> The increasing volume of high technology exports prompted concerns that the United States was supplying the Soviet military with the expertise and complex equipment that would raise Soviet technology to equal that of the western world.<sup>49</sup>

46. The dollar value of U.S. exports to the U.S.S.R. and Eastern Europe, between October 1971 and March 1972, was over twice that of the October 1968 to March 1969 period. This trend continued, and for the period from April 1978 to September 1978, total U.S. exports to the U.S.S.R., Eastern Europe, Laos, the Mongolian People's Republic, and the People's Republic of China were approximately seven times what they were in the period from April 1972 to September 1972. U.S. DEP'T. OF COMMERCE, 118 EXPORT AD. REP. 11 (1978). Nevertheless, the amount of trade between the United States and the Eastern bloc was only about 2.6% of that between other Western nations and the East. 1980 Senate Governmental Affairs Hearings, *supra* note 11, at 61 (statement of Lawrence J. Brady). Other sources have estimated the U.S. share of East-West technology trade at 10%. International Transfer of Technology, *supra* note 7, at 20. A brief historical review of trade with the U.S.S.R. is presented in Gershman, *Selling Them the Rope—Business and the Soviets*, COMMENTARY, April 1979, reprinted in 1980 Senate Governmental Affairs Hearings, *supra* note 11, at 6.

47. U.S. Embargo of Food and Technology to the Soviet Union: Hearings Before the Subcomm. on Int'l Finance of the Senate Comm. on Banking, Housing and Urban Affairs, 96th Cong., 2nd Sess. 90 (1980) (statement of Dr. William J. Perry, Undersecretary for Research and Engineering, DOD) [hereinafter cited as 1980 Senate Hearings].

48. 1980 Senate Governmental Affairs Hearings, *supra* note 11, at 61 (statement of Lawrence J. Brady). A 'turnkey' project is "a job or contract in which the contractor agrees to complete the work of building and installation to the point of readiness for operation or occupancy." WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 2468 (1976 Unabridged ed.). This liberalization of East-West trade policy was temporarily disrupted in 1978 with the Soviet dissident trials and the U.S. reaction to them, which took the form of a temporary trade embargo. President Carter prohibited the sale of a Sperry-Univac computer system to the U.S.S.R. and placed controls on the export of oil and gas technology to the U.S.S.R. After Moscow charged that this was a "path of confrontation" and Commerce alleged that there would be a chilling effect on exports, all 74 of the applications for export of oil technology to the U.S.S.R. were approved. Gershman, *Selling Them the Rope—Business and the Soviets*, COMMENTARY, April 1979, reprinted in 1980 Senate Governmental Affairs Hearings, *supra*, note 11, at 7. Although this trade embargo was an outgrowth of foreign policy rather than a measure taken for national security reasons, it provided some impetus for further investigation of the effectiveness of national security-based export controls. See generally 1978 Senate Hearings, *supra* note 11. In 1980, a trade embargo was again imposed on the export of agricultural products and high technology goods to the Soviet Union in response to the Soviet invasion of Afghanistan. Letter from President Carter to the Speaker of the House Thomas O'Neill and the President of the Senate Walter Mondale (Jan. 22, 1980) reprinted in 1980 Senate Hearings, *supra* note 47, at 46. Once again the political response was a statement of foreign policy, but it was heavily laden with national security concerns, as the Soviet action involved a military invasion of a sovereign nation rather than internal human rights violations.

49. Extension and Revision of the Export Administration Act of 1969: Hearings and Markup Before the Subcomm. on Int'l Economic Policy and Trade of the House Comm. on Foreign Affairs Part 1, 96th Cong., 1st Sess. 435 (1979) (statement of Dr. Ruth M. Davis) [hereinafter cited as 1979 House Int'l Economic Policy Hearings].

Concern with possible loss of the U.S. technological lead and the national security ramifications of such a loss resulted in the adoption of the critical technologies approach to export control in 1979.<sup>50</sup>

### III. DEVELOPMENT OF THE CRITICAL TECHNOLOGIES APPROACH

In 1974, the DOD's Defense Science Board established a task force on exports of U.S. technology. The results were reported in a February 1976 report entitled "An Analysis of Export Control of U.S. Technology—A DOD Perspective" (Bucy Report).<sup>51</sup> The Bucy Report emphasized "that control of design and manufacturing know-how is absolutely vital to the maintenance of U.S. technological superiority"<sup>52</sup> and that technological lead time is the critical factor in controlling exports for national security.<sup>53</sup> The Bucy Report recommended strict control over three types of exports that were believed to be the most effective transfer mechanisms for technology: 1) Arrays of design and manufacturing information that include detailed 'how to' instructions on design and manufacturing processes; 2) 'Keystone'<sup>54</sup> manufacturing, inspection, or automatic test equipment; 3) Products accompanied by sophisticated operation, application, or maintenance, information.<sup>55</sup> This "critical technologies" approach to export controls focused primarily on information transfer and only secondarily on process equipment and technology products because the Science Board's task force recognized that the more active the transfer mechanism, the more effective the technology transfer. Active transfer mechanisms, such as the establishment of turn-key projects, have as a primary goal the improvement of the technological capability of the receiving nation. In contrast, passive transfer mechanisms, such as trade shows and commercial literature, do not have a goal of technology transfer and the information that is transferred is usually already publicly available.<sup>56</sup>

The Bucy Report also recommended that the DOD develop a list of critical technologies, drawing upon the experience of individuals in both

50. Bucy Report, *supra* note 11.

51. *Id.* The task force was chaired by J. Fred Bucy of Texas Instruments Inc. *Id.* at vii.

52. *Id.* at iii.

53. *Id.* at 14. Protection of the U.S. technical lead time is most effective where export of revolutionary advances in a technology is prohibited, as such advances represent a "quantum jump" in the development cycle of a technology and therefore a large lead time advantage. Where developments have been only incremental, or evolutionary, controls may be imposed to maintain lead time but such controls are not as essential as those for revolutionary advances. *Id.* at 14.

54. "Keystone equipment is that equipment which is essential to a certain process but is unique as compared to the other equipment in the process. An example is much of the computer-controlled equipment in use today." *Id.* at 2.

55. *Id.* at 3.

56. *Id.* at 4-5.

government and industry.<sup>57</sup> Although some industry support for the critical technologies concept was expressed in Congressional hearings shortly after the Bucy Report was released,<sup>58</sup> a number of criticisms of the Bucy Report's recommendations were voiced by industry representatives:

1. The Department of Defense has too limited a knowledge base of current technology practice in Eastern Bloc countries as well as in other Western nations; and, therefore, its assumptions regarding uniqueness of some technology items are obsolete.
2. Strategic criteria for control of technology should give recognition to the opportunity for U.S. firms to sell obsolete technology.
3. The U.S. control list should not have unilateral listings, as compared to CoCom lists. This practice denied U.S. firms East-West trade, while allowing CoCom partners to capitalize on opportunities.
4. The transfer of "high technology" to the Soviets is not a significant problem, since they have limited resources or abilities to adapt technologies to new applications.<sup>59</sup>

In an attempt to prevent potential abuses of the critical technologies

57. *Id.* at 28, 30. Although the primary emphasis of the task force's recommendations concerned control mechanisms and rationales, a related goal of the critical technologies approach was recognized to be elimination of unnecessary controls and overall reduction in export license application processing time by more accurately focusing Commerce and DOD resources on the most critical problems for national security. *Id.* at 29. A decision flow chart in the Bucy Report outlines the recommended review process for technology transfers within the DOD under which technologies and products that are not sensitive can be approved for export quickly, leaving the time to focus on evaluation of the technologies that are critical to military development. *Id.* at 31.

58. *Extension of the Export Administration Act: Hearings of the Subcomm. on Int'l Finance of the Senate Comm. on Banking, Housing and Urban Affairs, 94th Cong., 2d Sess. 299 (1976)* (statement of Thomas Christiansen, Int'l Trade Relations Manager, Hewlett-Packard) [hereinafter cited as *1976 Senate Hearings*].

59. *1978 House Science and Technology Hearings, supra* note 35, at 202-03 (statement of Charles H. Phipps). Responses to the criticisms reflected the perspective of the Bucy Report's contributors:

1. While Eastern bloc nations do tend to have serious deficiencies in defining requirements and implementing technologies for their visible commercial sectors, their military sectors are mission oriented, and have high priorities. Although only limited information is known about state-of-the-art technologies for military projects, it is known that these programs do not have the administrative and planning barriers that exist in the commercial sectors.
2. Today, the administration of U.S. controls has the implicit effect of unilateral controls, due to excessive delays, as well as deficiencies in interpretation of lists between U.S. and other CoCom countries. The actual items under control should be based on their criticality to significant weapon systems. At times, it may be necessary to unilaterally place it on the U.S. lists. Otherwise, it is desirable to approach multilateral listings.
3. The rate of advance of a specific technology is predictable for its evolutionary, year-to-year advances. However, the significant advances are not predictable, and when these occur they should be protected and weighed versus their impact on receiving nations, in order to maximize lead time. A criteria of obsolescence based on U.S. practice limits lead time to U.S. product life, which may be only 5 years or less.
4. The charge that DOD has too limited a knowledge of current technology practice for both the Soviet Union and Western countries has merit. It can be overcome by assigning adequate intelligence resources to this area, and by interacting with industry in the review and update.

*Id.* at 203-04.

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approach, a number of companies offered their assistance in developing critical technologies list.<sup>60</sup> The DOD also sponsored a study by Battelle Columbus Laboratories to suggest methods of implementing the Bucy Report recommendations.<sup>61</sup>

In August 1977, the DOD formalized adoption of the Bucy Report recommendations in a policy statement entitled "Interim DOD Policy Statement on Export Control of United States Technology."<sup>62</sup> The technical staff within the DOD, whose task it is to evaluate export license applications referred from Commerce, was instructed to focus review attention on those exports that represented the most effective technology transfer mechanisms. The DOD's progress in developing lists of critical technologies was much slower than originally estimated and this led to some Congressional skepticism about whether the critical technologies approach would ever be fully implemented.<sup>63</sup> Then, in 1979, Congress was faced with the expiration of the EAA of 1969. Among the proposals for revising that Act was one calling for the adoption of the critical technologies approach.<sup>64</sup> While industry views on

60. The offers of assistance were prompted by a concern that the critical technologies approach might give the DOD an opportunity to prohibit even more exports than were presently being controlled. *See generally 1976 Senate Hearings, supra* note 58. Therefore, industry participation in the development of the Militarily Critical Technologies List (MCTL) was not necessarily indicative of support for the approach.

61. In August 1976 the Office of Science and Defense (OSD) steering group chaired by the office of the Under Secretary of Defense for Research and Engineering (DDR&E) (International Programs) requested Battelle Columbus Laboratories (Battelle) to suggest implementation plans for the recommendations in the Bucy Report. Battelle conducted Phase I of the study from August to September 1976, during which time they identified twenty strategically significant technologies (SSTs): electrochemical energy storage; low light level imaging; superconductors; boron fibers; metal-matrix composites; carbon-carbon composites; CAD/CAM software; airframes; physical vapor deposition; electroforming; inertial navigation systems; microprocessors; infrared detectors; centrifugal compressors; numerical control; integrated circuit manufacturing; remote sensing; jet engines; high density optical recording; and hot isostatic processing. Battelle Columbus Laboratories. Selected Excerpts of Preliminary Reports on Identification of Strategically Significant Technologies (Jan. 7, 1977). They also analyzed international competitive positions, including the position of the United States versus the Soviet Union, the United States versus the industrialized West and the industrialized West versus the Soviet Union. BATTELLE COLUMBUS LABORATORIES, PHASE I REPORT ON IDENTIFICATION OF STRATEGICALLY SIGNIFICANT TECHNOLOGIES (Oct. 18, 1976); Battelle Columbus Laboratories, Preliminary Reports on Identification of Strategically Significant Technologies (Oct. 29, 1976). The results of the Battelle study were criticized by industry for the lack of specificity in designation of the technologies that should be controlled and for the lack of evaluation of scientific exchanges as a method of technology transfer. Without very specific technologies identified for control, more technological items and information could be unnecessarily restricted under the critical technologies approach than under the Commodity Control List (CCL), a result not intended by the Bucy Report's task force.

62. 1977 DOD Interim Policy Statement, *supra* note 8.

63. *Extension and Revision of the Export Administration Act of 1969: Hearings and Markup Before the House Comm. on Foreign Affairs, Part 2, 96th Cong., 1st Sess. 99-100 (1979)* (statement of Dr. Ruth M. Davis) [hereinafter cited as *1979 House Foreign Affairs Hearings*].

64. EAA of 1979, *supra* note 9.

incorporating the critical technologies approach outlined in the Bucy Report into the 1979 legislation were mixed,<sup>65</sup> Congress chose, after considerable debate on the use and proper scope of export controls for national security purposes, to adopt most of the Bucy Report recommendations.<sup>66</sup>

The Export Administration Act of 1979 (EAA of 1979)<sup>67</sup> continues the government's emphasis on promoting export trade and imposing export controls "only to the extent necessary . . . to restrict the export of goods and technology which would make a significant contribution to the military potential of any other country or combination of countries which would prove detrimental to the national security of the United States."<sup>68</sup> Under the EAA of 1979, however, the method of implementing the policy changed. The EAA of 1979 requires development of a Militarily Critical Technologies List (MCTL) to be used in the export approval process.<sup>69</sup> Statutory guidelines for the MCTL are identical to descriptions previously stated in the Bucy Report and in the 1977 Interim Policy Statement,<sup>70</sup> and, on October 1, 1980, the MCTL was pub-

65. For comments favorable to the critical technologies approach see *1979 House Int'l Economic Policy Hearings*, *supra* note 49, at 488-90 (statement of Jane P. Davis). Other industry representatives were cynical about the export benefits of the critical technologies approach on the basis of past experience with DOD controls. Letter from Thomas A. Christiansen, Manager of Int'l Trade Relations, Hewlett-Packard to Rep. Jonathan B. Bingham (Mar. 30, 1979). *Id.* at 1002-03; *Id.* at 522 (statement of Thomas A. Christiansen). Some manufacturers of semiconductors and other high-technology electronic products were reported to have favored export controls for only foreign policy purposes, eliminating entirely the national security and short domestic supply export controls. See *Update of U.S. Export Controls Urged*, 110 AVIATION WEEK & SPACE TECHNOLOGY 119 (June 11, 1979). Other industry representatives testified in Congressional subcommittees that foreign policy export controls should be abolished because they do not prevent the embargoed country from obtaining the desired technology, but only prevent the U.S. companies from making the sale. *1979 House Int'l Economic Policy Hearings*, *supra* note 49, at 197.

66. 125 CONG. REC. H37713-15 (daily ed. Sept. 29, 1979).

67. EAA of 1979, *supra* note 9.

68. *Id.* at § 2402(2). In September 1978, President Carter reactivated the President's Export Council, whose task it was to recommend government programs to increase U.S. exports and increase the "export-consciousness" of business. Exec. Order No. 12131, 44 Fed. Reg. 26,841 (1979), *reprinted in* 50 U.S.C. §§ 2401-13, at 304 (Supp. 1980). Final recommendations by the Council included strengthening and integrating the federal government's international trade functions, eliminating or reducing export disincentives, and using export controls only where absolutely necessary. *President's Export Council Urges Rapid Export Expansion*, 3 BUS. AM. 2 (Dec. 1, 1980). In September 1980, increased export trade as a national goal was again emphasized by the President in a report to Congress. PRESIDENT'S 1980 EXPORT REPORT, *supra* note 12. Many of the findings reported in the President's report are reiterated in the final recommendations of the President's Export Council made in December 1980. *President's Export Council Urges Rapid Export Expansion*, 3 BUS. AM. 2 (Dec. 1, 1980).

69. EAA of 1979, *supra* note 9, at § 2404(d).

70. The EAA of the 1979 states:

In developing such list, primary emphasis shall be given to—

(A) arrays of design and manufacturing know-how,  
(B) keystone manufacturing, inspection, and test equipment, and



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lished in the *Federal Register*.<sup>71</sup> Ultimately, the MCTL will be incorporated into the CCL upon the concurrence of the Secretary of Commerce and the Secretary of Defense;<sup>72</sup> this incorporation is tenta-

(C) goods accompanied by sophisticated operation, application, or maintenance know-how, which are not possessed by countries to which exports are controlled under this section and which, if exported would permit a significant advance in a military system of any such country.

EAA of 1979, *supra* note 9, at § 2404(d)(2). The Secretary of Defense has primary responsibility for developing the MCTL. *Id.* Difficulties arose in assigning the responsibility for development of a MCTL and in deciding what approvals would be necessary for the MCTL to be incorporated in the Commodity Control List (CCL). 125 CONG. REC. H8715 (daily ed. Sept. 28, 1979) (remarks of Rep. Lagomarsino). Ultimately, the DOD was given the responsibility for developing the MCTL by October 1, 1980, but both the Secretaries of Commerce and Defense must agree on items to be placed on the CCL. EAA of 1979, *supra* note 9, at § 2404(d).

In order to have a MCTL prepared for the October 1, 1980 publication date, the Deputy Under Secretary of Defense for International Programs and Technology contracted with the Institute of Defense Analysis (IDA) to develop the list. The IDA Critical Technologies Project limited its scope of review by eliminating photographic equipment, military equipment, and atomic energy from consideration, organizing the project into seven Technical Working Groups (TWG), and considering only technologies that support products on the CCL for national security reasons. The seven TWGs were: chemicals and materials; transportation; telecommunications; avionic navigation and naval equipment; semiconductors and electronic components; electronic instrumentation; and computers. Institute of Defense Analysis, Report R-258, The Critical Technologies Project Volume I: Executive Summary ii (Jan. 7, 1981). Each TWG was headed by an IDA employee and group members were selected from industry, academia, and government for their technical expertise and familiarity with technology transfer. Each TWG developed lists of technology elements corresponding to the three stages of "making something": development, production, and product utilization. *Id.* at I-17. These elements were arranged in the three categories mandated in the 1979 EAA: arrays of technical information and know-how, keystone equipment, and goods accompanied by sophisticated technical information and know-how. EAA of 1979, *supra* note 9, at § 2404(d)(2). Approximately 1090 critical technologies and the most effective transfer mechanisms for each were identified. The military utility and state of adversary development of each technology were also evaluated. Results of the IDA study were reported to the DOD for integration with lists of technologies that had been identified by the military services. Institute of Defense Analysis, Report R-258, The Critical Technologies Project, Volume I: Executive Summary I-8 (Jan. 7, 1981).

71. Seventeen categories of technologies were listed, with detailed listings of more specific technologies for 16 of the 17 areas. The 17 categories were: computer networks technology; computer technology; software technology; automated real-time control technology; materials technology; directed energy technology; semiconductor and electronic component technology; instrumentation technology; telecommunications technology; communication, navigation, guidance and control technology; microwave technology; vehicular technology; optical and laser technology; sensor technology; undersea systems technology; chemical technology; and nuclear specific technology. 45 Fed. Reg. 65,015 (1980). Publication was required under the EAA of 1979. EAA of 1979, *supra* note 9, at § 2404(d)(4).

72. EAA of 1979, at § 2404(c)(2). The President has the responsibility for resolving disagreements between the Secretary of Commerce and the Secretary of Defense concerning which technologies and goods should be put on the CCL. *Id.* Current work schedules on the critical technology project within the DOD list May, 1981 as a target date for integrating public comments on the lists published in the October 1, 1980 *Federal Register* with the Department of Energy list and the DOD list. Interview with Col. John Hager, Deputy Under Secretary of Defense for Research and Engineering, International Programs and Technology, Office of Technology Trade, Department of Defense, in Arlington, Va. (Jan. 8, 1981) [hereinafter cited as Hager Interview]. Implementation of the Interim DOD policy statement on technology export controls, 1977 DOD Interim Policy State-



tively scheduled for early 1982.<sup>73</sup>

#### IV. DOD INVOLVEMENT IN THE EXPORT LICENSING PROCESS AND APPLICATION OF THE CRITICAL TECHNOLOGIES APPROACH

Authority for licensing the export of most commodities and unpublished technical data rests with Commerce's Office of Export Administration (OEA).<sup>74</sup> Under the 1979 EAA,<sup>75</sup> the three basic types of export licenses are (1) the validated license for a specific export by a specific exporter; (2) the qualified general license for multiple exports by a specific exporter; and (3) the general license, for which no application is necessary.<sup>76</sup> A validated license is required for commodities on the

ment, *supra* note 8, began in early 1978 by the Department of Defense for Research and Engineering with the establishment of five Critical Technology Expert Groups (CTEGs): (1) materials and structures, jet engines and wide body aircraft; (2) computer networks, high-energy lasers and infrared detection; (3) Large Scale Integrated production technology; (4) array processors; and (5) acoustic arrays. High technology trade associations were requested to direct the five groups. TECHNOLOGY TRANSFER TASK GROUP, INTERNATIONAL COUNCIL, AEROSPACE INDUSTRIES ASSOCIATION, SUMMARY REPORT ON TECHNOLOGY TRANSFER CONTROLS (prepared for the AIA Board of Governors Ad Hoc Group, May 26, 1978). Industry experts were called upon to identify the militarily critical technologies from a list of 55 basic technologies in 9 major fields. *Id.* By January 1979, a list of 15 technologies had been prepared, reflecting an emphasis on computer-related technologies that did not appear in the list of 20 strategically significant technologies developed by Battelle: computer network technology; large computer system technology; software technology; automated real-time control technology; composite and defense materials processing and manufacturing technology; directed energy technology; large-scale and very-large-scale integration design and manufacturing technology; military instrumentation technology; telecommunications technology; guidance and control technology; microwave componentry technology; military vehicular engine technology; advanced optics (including fiber optics) technology; sensor technology; and undersea system technology. 1979 House Int'l Economic Policy Hearings, *supra* note 49, at 410 (statement of Dr. Ruth M. Davis). According to testimony from DOD representatives, three years were required to develop the first militarily critical technologies list because of the large amount of interaction required between industry, the intelligence community, and the DOD. 1979 House Foreign Affairs Hearings, *supra* note 63, at 99 (statement of Dr. Ruth M. Davis).

73. Hager Interview, *supra* note 72. By this time the CoCom partners will have been fully briefed on the critical technologies approach to export licensing, *id.*, in preparation for the upcoming regular CoCom list revision in 1983 and potential incorporation of the militarily critical technologies approach into the CoCom export control process. The most recent CoCom list revision became effective on April 1, 1980, EXPORT AD. REP., *supra* note 17, at 45, and was published on June 25, 1980. 45 Fed. Reg. 43,010 (1980); EXPORT AD. BULL. 206 (June 25, 1980).

The EAA of 1979 recognizes the importance of international coordination of export controls, and four objectives of United States-CoCom negotiations are listed in the 1979 EAA: 1) Publication of the CoCom export control list 2) Periodic international high-level export policy meetings 3) Reduction of the scope of export controls 4) More effective procedures for enforcing those export controls that are retained. EAA of 1979, *supra* note 9, at § 2404(i).

74. Exec. Order No. 12002, 42 Fed. Reg. 35,623 (1977) reprinted in 50 U.S.C. app. § 2403, at 308 (1980) provides for this power to be delegated to the Secretary of Commerce with the power of successive redelegation. Exports to U.S. territories and possessions and most exports to Canada do not require licenses. EXPORT AD. REP., *supra* note 17, at 5-6.

75. EAA of 1979, *supra* note 9.

76. *Id.* at § 2403(a). Previously there were only two types of licenses; the qualified general

CCL<sup>77</sup> when they are to be exported to certain groups of countries.<sup>78</sup> Exports requiring less restrictive controls are authorized under a qualified general license or four other special licenses.<sup>79</sup> In addition, export authorizations are required for all reexports, i.e. goods originally from the United States that are shipped from one foreign country to another.<sup>80</sup> Furthermore, exports that are on the CoCom list can only be exported if all of the CoCom member nations agree to grant an exception for that export.<sup>81</sup>

The role of the DOD in processing export license applications under the 1979 EAA is virtually the same as it was under the 1969 EAA.<sup>82</sup> All applications are submitted to Commerce and, whenever possible, Commerce is to make the export license decisions without consulting any other government department or agency.<sup>83</sup> The DOD, however, can re-

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license is a new feature of the 1979 EAA designed to ease Commerce's administrative burden and to encourage export activity. 45 Fed. Reg. 45,894 (1980) (to be codified in 15 C.F.R. § 373.4). For testimony in support of three types of export licenses rather than two types, see 1979 House Int'l Economic Policy Hearings, *supra* note 49, at 489 (statement of James P. Davis).

77. 15 C.F.R. §§ 399 and 372.1(b) (1980). The CCL has recently been simplified and updated to conform more closely to the revised CoCom export controls. EXPORT AD. REP., *supra* note 17, at 18.

78. 15 C.F.R. § 370, Supp. No. 1. Eight country groups are listed in the current Export Administration Report. EXPORT AD. REP., *supra* note 17, at 7. For each commodity listed, the CCL also lists the country group or groups for which validated export licenses must be obtained. *Id.* at 6. The country groups are continuously subject to change in accordance with national policy and the world situation. For example, the People's Republic of China (PRC) was moved from Country Group Y, which includes the Soviet Union and other Eastern Bloc countries, to Country Group P, a newly established designation, on April 25, 1980. 45 Fed. Reg. 27,922 (1980). The licensing guidelines applicable to the PRC do not require license denial in all cases where the end-user will use the product for military purposes. EXPORT AD. REP., *supra* note 17, at 53-55.

79. The project, distribution, and service supply licenses are used for export of commodities and services to certain country groups. The aircraft and vessel repair station procedure reduces the documentation requirements for foreign repair, maintenance, and servicing of aircraft using U.S. parts. 15 C.F.R. § 272 (1980). Tabulations of the number of special licenses issued and in use are found in EXPORT AD. REP., *supra* note 17, at 11. Exports requiring no license application must file a Shipper's Export Declaration with Commerce. 15 C.F.R. § 271.2(a) (1980).

80. EXPORT AD. REP., *supra* note 17, at 5. See also note 23 *supra*.

81. Such exports effectively go through a second export approval process after Commerce approves the export license application. COMPTROLLER GENERAL, REPORT TO CONGRESS, EXPORT CONTROLS: NEED TO CLARIFY POLICY AND SIMPLIFY ADMINISTRATION 10, 15 (Mar. 1, 1979). See text accompanying notes 19-20 *supra*.

82. Perhaps the only change in export licensing procedure in the 1979 EAA is the stringent requirement for rapid processing and response to the prospective exporter's application, EAA of 1979, *supra* note 9, at § 2409(d), a matter of considerable concern in the hearings prior to its enactment. See generally 1979 House Int'l Economic Policy Hearings, *supra* note 49. Within 30 days of receipt of the export license application, the Office of Export Administration (OEA) must refer it to all agencies required to review it. The reviewing agency has 30 days to respond to OEA, but the agency can request an additional 30 days. Where a proposed export is on the CoCom list requiring CoCom approval before export is permitted, the application is processed through Commerce and the other applicable agencies before it is submitted to CoCom. 15 C.F.R. § 370.13 (1980).

83. EAA of 1979, *supra* note 9, at § 2409(a)(2).

view proposed exports of "goods or technologies to *any country* to which exports are controlled for national security purposes."<sup>84</sup> The types of export license applications that will be sent to the DOD for review are determined by the Secretary of Defense in consultation with the Secretary of Commerce.<sup>85</sup> Generally, only those export license applications that "raise acute national security concerns" are reviewed by the DOD.<sup>86</sup> Only the President can override a recommendation by the Secretary of Defense to deny an export application on national security grounds and if the President does override the recommendation, he must then report his decision to Congress.<sup>87</sup>

While the language of the EAA of 1979 does not change the DOD's role in the export license decision, the change in emphasis<sup>88</sup> from control of products to control of technologies may provide a basis for a more expansive interpretation of the DOD's authority. In its 1977 policy statement,<sup>89</sup> the DOD implemented some of the Bucy Report recommendations calling for tighter controls over technology transfers.<sup>90</sup> The breadth of coverage anticipated by the policy statement was considerably more than that previously assigned to the DOD.<sup>91</sup> The policy statement advocated DOD control of inadvertent technology transfers in the context of foreign liaison activities, scientific and technical exchanges, commercial visits, trade fairs, training programs, sales proposals, and consulting agreements, whether involving a government department or agency, a commercial enterprise, an academic or non-profit institution, an individual entrepreneur, or foreign governments and international organizations.<sup>92</sup> Although the EAA of 1979 did not institute the policy

84. *Id.* at § 2409(g)(1) (emphasis added).

85. *Id.* at § 2409(g)(2). Of 6506 such applications from October 1979 to September 1980, 4225 were exempted from DOD review. EXPORT AD. REP., *supra* note 17, at 61.

86. *U.S. Technology Transfers*, *supra* note 4, at 1052. Those applications are reviewed either by the Interagency Operating Committee or by DOD and Commerce. EXPORT AD. REP., *supra* note 17, at 61.

87. 1979 EAA, *supra* note 9, at § 2409(g)(4).

88. During hearings prior to the enactment of the EAA of 1979, the difference between the prior licensing approach and the critical technology approach was identified as one of emphasis. *House Int'l Economic Policy Hearings*, *supra* note 49, at 434.

89. 1977 DOD Interim Policy Statement, *supra* note 8.

90. *Id.* Sales of end products to potential adversaries would be recommended only where:

1. the product's technology content is either difficult, impractical, or economically infeasible to extract,
2. the end product in question will not of itself significantly enhance the recipient's military or war-making capability, either by virtue of its technology content or because of the quantity to be sold, and
3. the product cannot be so analyzed as to reveal U.S. system characteristics and thereby contribute to the development of countermeasures to equivalent U.S. equipment.

*Id.* at 92.

91. *Id.* at 91.

92. *Id.* at 92.

statement's expansion of the DOD's export licensing authority, the possibility of an expanded DOD role exists should it become politically desirable.<sup>93</sup>

Although the DOD's role in the export licensing process has not been altered by the EAA of 1979, the change in emphasis provides a new perspective from which to assess licensing decisions, particularly previous decisions that were controversial. Similarly, the new focus on technologies, rather than products, highlights the problems associated with exports in certain technology areas such as computer software.

One widely publicized series of export decisions involved the Kama River truck plant in the Soviet Union. Between 1971 and 1980, Commerce issued a series of export licenses for automotive technologies and production equipment for the plant. Although the U.S. government suspected that the plant could be used to produce military vehicles,<sup>94</sup> Commerce did not require any Soviet end-use statements declaring that the vehicles from the Kama River plant would not be used for military purposes.<sup>95</sup> During the period the licenses were granted, of all the technologies and equipment exported for the plant, only the 1975 export licensing of the IBM 370 computer was considered controversial. The export license for the computer included safeguard provisions to assure that computer time would not be diverted to military uses, but those provisions allowed U.S. inspectors to visit the computer site only until seventy-five percent of the plant's computer time has been used.<sup>96</sup> Although U.S. intelligence sources discovered in 1977 that the Soviets were using trucks manufactured at the Kama River plant for military purposes,<sup>97</sup> it was not until May 1980 that a pending export license application for a diesel engine assembly-line system for the plant was denied.<sup>98</sup>

93. During hearings following the Soviet invasion of Afghanistan, Dr. William J. Perry of the DOD stated that the DOD intended to propose restrictions on Soviet students who wish to study high-level technology in the United States. *1980 Senate Governmental Affairs Hearings*, *supra* note 11, at 29-30 (statement of Dr. William J. Perry, Undersecretary for Research and Engineering, DOD).

94. According to the DOD, as early as 1971, the DOD, Commerce, the Department of State and the CIA anticipated that some of the vehicles produced at the Kama River plant would be used for military purposes. *1980 Senate Governmental Affairs Hearings*, *supra* note 11, at 53 (prepared responses by the DOD to subcommittee questions).

95. The lack of end-use statements has been attributed to the prevailing climate of détente at the time of the export licenses. *1980 Senate Governmental Affairs Hearings*, *supra* note 11, at 35 (statement of Sen. Henry M. Jackson); *1980 Senate Hearings*, *supra* note 47, at 41 (exchange between Sen. William Proxmire and Secretary of Commerce Philip M. Klutznick).

96. *1980 Senate Governmental Affairs Hearings*, *supra* note 11, at 67 (statement of Lawrence J. Brady).

97. *1980 Senate Hearings*, *supra* note 47, at 98 (prepared responses by the DOD to subcommittee questions).

98. *Kama River Truck Factory: Best, and Worst of Tech Export*, INDUS. RESEARCH & DEV., July 1980, at 56.

The denial followed the discovery that the Soviet Union had used trucks manufactured at the plant in the 1979 invasion of Afghanistan.<sup>99</sup>

The Soviet Union's use of trucks manufactured at the Kama River plant in the invasion of Afghanistan has prompted investigations into export controls on strategic technologies and products and criticism of the Kama River licensing decisions. DOD officials have indicated that, given the same circumstances that existed at the time of approval, those licenses would now be denied under the new U.S. export policy.<sup>100</sup> Under the critical technologies approach, the applications for export licenses for the Kama River truck plant would be subjected to strict scrutiny because technology and production equipment, rather than simply products, were proposed for export. Nevertheless, the DOD's assertions may be incorrect. Based on information available at the time the original export licenses were granted, the DOD determined that the exports to the plant would not make a "significant contribution to the military capability" of the Soviet Union.<sup>101</sup> The DOD continued to believe this even when use of the vehicles for military purposes was discovered in 1977 because the extent of the military use of the trucks was not then known.<sup>102</sup> It was not until 1979 that the United States was fully aware of the military ramifications of the plant.<sup>103</sup> Therefore, it is possible that even with the critical technologies-based approach, the United States would have approved those export licenses.

One export license application was actually analyzed under the critical technologies approach before that approach was legislatively adopted. In 1978, Dresser Industries applied the approach to export technology, data, and equipment for constructing oil drilling rock bit manufacturing plants in the Soviet Union. The plants were designed to produce large numbers of high-quality rock drill bits of a design used in drilling deep oil wells. The DOD originally recommended license approval on two grounds: the transfer of the technology and the export of the turnkey factory would not enhance Soviet military capability,<sup>104</sup> and the drill bit production technology was available from other

99. *Id.*

100. 1980 *Senate Governmental Affairs Hearings*, *supra* note 11, at 28 (exchange between Dr. William J. Perry, Undersecretary of Research and Engineering, DOD and Sen. Henry M. Jackson).

101. *Id.* at 49 (statement of Dr. William J. Perry).

102. *Id.* at 32 (exchange between Dr. Jack Vorona and Sen. Sam Nunn). Furthermore, in 1978 nine applications for the export of equipment, including computer spares, to the Soviet ZIL complex, where trucks and missile launchers for the Soviet military are produced, were approved on the ground that they were not significant contributions to Soviet military capability, although they were undoubtedly used by the Soviet military. *Id.* at 49 (statement of Dr. William J. Perry).

103. *Id.* at 32 (exchange between Sen. Sam Nunn and Dr. Jack Vorona).

104. *Id.* at 95, 98 (statement of Dr. William J. Perry). The DOD acknowledged, however, that the export would have a "profound economic and political impact." *Id.* at 98.



sources.<sup>105</sup> Later, concern that transfer of the deep-well technology and the capability to manufacture the rock drill bits would compromise U.S. national security prompted reviews by the DOD, Commerce and the Department of Energy (DOE). J. Fred Bucy, the chairman of the task force that produced the Bucy Report, conducted a brief review of the export decisions at the request of the Defense Science Board. He recommended that the DOD withdraw its approval of the export licenses on the grounds that the premium rock drill bit technology was a critical technology not available from foreign sources in either the quality or the quantities represented by the export licenses.<sup>106</sup> Nevertheless, the DOD affirmed its license recommendations. It found, in addition to the reasons previously given for the export approval, that the drill bit production facility would not be operational until 1981, thus preserving some technological lead time, and that the effect on U.S. national security of improving the Soviet's oil exploration capability was unresolved.<sup>107</sup> The President reviewed Dresser Industries' export licenses in September 1978 and declined to revoke them.

Evaluating Dresser Industries' exports by the critical technology approach mandated in the EAA of 1979<sup>108</sup> indicates that, contrary to Bucy's recommendations, the license applications were properly approved. As stated in Congressional hearings, the only portion of the export package that had any potential military use was the tungsten carbide technology which is also used in making penetrators for armor piercing projectiles.<sup>109</sup> Because the Soviet Union has had this technology

105. *Id.* at 107 (statement of Dr. Ellen Frost).

106. *Id.* at 6-10 (statement of J. Fred Bucy).

107. *Id.* at 12-13 (Memorandum to National Security Advisor Zbigniew Brzezinski from Secretary of Energy, Charles W. Duncan, Jr. (Aug. 26, 1978)). Dr. William J. Perry of the DOD indicated that the Administration had not decided whether exports that would improve the Soviet Union's oil production capability should be restricted. Improved Soviet oil production might benefit U.S. national security because the Soviet Union would have less desire to acquire oil-producing lands outside their country.

The opposing argument is that restriction of oil production technology exports to the Soviet Union would require them to spend proportionally more of their resources developing such a capability, leaving less resources for development of military capacity. *Id.* at 98-99 (statements of Sen. Charles H. Percy and Sen. Henry M. Jackson). As Sen. Charles H. Percy pointed out, the fact that the President decided to permit the Dresser Industries' exports to proceed seems to indicate that some policy conclusion on enhancing Soviet energy exploration capabilities must have been reached with respect to the Dresser Industries cases, even if such a policy has not been formulated in broad terms. *Id.* at 108 (statement of Sen. Charles H. Percy). The issue of exporting technology for energy exploration to the Soviet Union was also discussed at hearings before a subcommittee of the House Committee on Science and Technology. 1978 House Science and Technology Hearings, *supra* note 35, at 173-80 (exchange among Dr. Maurice Mountain, Rep. James H. Scheuer, Col. John A. Hager, and Dr. William A. Root).

108. EAA of 1979, *supra* note 9, at § 2404(d).

109. 1978 House Science & Technology Hearings, *supra* note 36, at 173 (statement of Dr. Maurice Mountain).



for a considerable length of time, approval of the export is required under the "foreign availability" clause of the EAA of 1979.<sup>110</sup> The argument that the exports should be denied because of their enhancement of Soviet energy exploration capability appears to be a case of applying a resource-freeing theory<sup>111</sup> to export decisions, similar to the rationale used to support the ban on consumer as well as military goods under the Export Control Act.<sup>112</sup> Neither current export policy nor the recent statutes support this restrictive interpretation of a critical technology.

One final export case deserves to be examined in light of the critical technologies approach of the EAA of 1979. Walter and Frances Spawr and their company, Spawr Optical Research, were recently convicted for unlawful export of three-inch diameter copper and water-cooled laser mirrors, and conspiracy to transship the mirrors.<sup>113</sup> Although information regarding export licenses is usually kept confidential to protect exporters' business interests,<sup>114</sup> the circumstances of this export license application and denial were published because an export violation was prosecuted. The facts surrounding the license application arose in 1976, when Spawr Optical Research applied for a license to export copper and water-cooled laser mirrors to the Soviet Union. The license request was denied on the grounds that the mirrors might be used in Soviet "killer satellites"<sup>115</sup> and therefore their export would be inimical to the na-

110. EAA of 1979, *supra* note 9, at § 2404(f).

111. The basic premise of a resource-freeing theory is that Soviet resources that are not required for development of commercial technology, such as energy exploration techniques, will be allocated to military development. *U.S. Technology Transfers*, *supra* note 4, at 1063-65.

112. ECA of 1949, *supra* note 3.

113. *Couple Guilty of Selling High-Technology Optics to Soviets*, L.A. Times, Dec. 13, 1980, at 1, col. 1; *2 Convicted of Selling Laser Mirrors to Soviets*, L.A. Herald Examiner, Dec. 13, 1980, at A3, col. 1. Sixteen cases of "known" illegal diversions of U.S. technology to the Soviet Union and Eastern Europe were discussed in a secret 1980 Commerce study, later made public by Rep. John Ashbrook (R-Ohio). *Illegal High-tech Shipments Include Goods and Know-how*, INDUS. RESEARCH & DEV. at 56 (July, 1980). Such diversions most commonly occurred through a third party and included advanced computers and software, laser technology, and electronic test equipment. *Id.* More recently, three Canadian citizens have been charged by the Canadian government with illegally exporting to Pakistan 11 shipments of U.S. made parts for an inverter that could be used in a uranium-enrichment plant. *Pakistan Said to Receive Nuclear Arms Parts Illegally via Canada*, Wash. Post, Dec. 7, 1980, at A37, col. 1.

114. Information about specific export application denials or approvals is classified and therefore generally unavailable unless there is prosecution for exporting activities, or a Congressional investigation, as was the case with the Kama River truck plant and Dresser Industries exports. It is only through the prosecution of the Spawr case that details concerning the proposed exports have become public. Summaries of the export license actions taken and very general descriptions of the types of equipment granted or denied licenses are provided in the annual Export Administration Report published by the Department of Commerce. *See, e.g.*, EXPORT AD. REP., *supra* note 17, at 56-60, Appendix E.

115. *Couple Guilty of Selling High-Technology Optics to Soviets*, L.A. Times, Dec. 13, 1980, at 1, col. 1.

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tional security of the United States. Subsequent to the denial of the application, the Spawrs were arrested for unlawfully exporting the mirrors. Although the Spawrs' defense attorney argued that the mirrors could not be used in weapons, other sources indicated that "significant research" could be conducted with the laser mirrors, which are often used in high-powered long-range lasers.<sup>116</sup> According to the prosecutor in the case, the mirrors "involve significant, state of the art technology,"<sup>117</sup> and the Spawrs' mirrors were "among the best quality of any made in the United States."<sup>118</sup>

Denial of the license application was correct under the critical technology approach. The technology embodied in the copper and water-cooled laser mirrors falls within the MCTL category 6.1.2, Mirror and Optical Device Technology, a subcategory of High Energy Laser Technology, and their export is restricted.<sup>119</sup> The Spawr export request did not propose the transfer of technology by any of the active mechanisms recognized as being the most effective, but proposed only a product sale, unaccompanied by any specialized training or instruction. Nevertheless, the sale of the mirrors was rightly controlled, because the mirrors may have a significant military utility in themselves.<sup>120</sup> Although similar mirrors are reportedly available from other U.S. sources, even the Spawrs' defense attorney acknowledged that the Spawrs have "the technology to make the best in the world."<sup>121</sup> Assessments of the mirrors' foreign availability are currently classified.<sup>122</sup>

The three export licensing cases, the Kama River truck plant, the Dresser Industries rock drill bit plant, and the Spawr mirrors, illustrate the importance of DOD officials having detailed knowledge about the state of the art in the relevant technology field. The required expertise poses little problem in the three cases; because these cases all involve

116. *Indictment in Soviet Laser Mirror Deal*, L.A. Herald Examiner, Sept. 4, 1980, at A12, col. 2.

117. *2 Convicted of Selling Laser Mirrors to Soviets*, L.A. Herald Examiner, Dec. 13, 1980, at A3, col. 1.

118. *Couple Guilty of Selling High-Technology Optics to Soviets*, L.A. Times, Dec. 13, 1980, at 1, col. 1.

119. 45 Fed. Reg. 65,016 (1980).

120. Five questions for identification of key areas where export controls would be most useful were listed in the Bucy Report:

1. Does the material or product have a significant military utility in itself, based on performance capabilities?
2. Does it provide a critical manufacturing capability, supportive of strategic products or technologies?
3. Does the transaction involve active steps toward the transfer of technology?
4. Does it impact technology in a form useful in manufacturing or design?
5. Is the technology in question one which is changing with high velocity?

Bucy Report, *supra* note 11, at 17.

121. *Indictment in Soviet Laser Mirror Deal*, L.A. Herald Examiner, Sept. 4, 1980, at A12, col. 2.

122. 45 Fed. Reg. 65,015 (1980).

physical equipment and associated technology, exports that Commerce and the DOD have experience in regulating, there are no difficult conceptual problems in applying the critical technologies approach. Computer system data (software), in contrast, may prove difficult to analyze under the critical technologies approach; it is a technology area that presents some of the most complex conceptual and practical problems in export controls.<sup>123</sup> Recent growth in computer development and applications and the superiority of U.S. technology in the computer field has created a strong demand for U.S. exports in the field,<sup>124</sup> and, because the field is so technically complex, the hardware exported is almost use-

123. Computer software is defined as:

[d]ata and information that are associated with the hardware of a machine or system; for example, a collection of computer programs, routines, compilers, assemblers, translators, manuals, circuit diagrams, and operational procedures. Software must be written, recorded, or represented somehow, even if in the form of a program stored in a plugboard, in which case it is also considered hardware.

M. WEIX, *DICTIONARY OF COMPUTERS AND INFORMATION PROCESSING* 321 (2d ed. Rev. 1977)

Computer hardware is defined as:

[p]hysical equipment, such as the mechanical, magnetic, electronic, or electrical devices or components from which assemblies are made, or the assemblies themselves; for example, the assembly of material that forms a computer, as distinct from data, routines, or programs. An entire computing system is considered a hardware item. Previously, only metal attachments, such as clamps, nuts, bolts, hinges, and screws, were considered as hardware items; now, any sort of apparatus is considered hardware.

*Id.* at 175.

124. In fiscal year 1980 (October 1979 to September 1980), the following licenses for export of electronic computing equipment and software were granted:

1. *Electronic Computing Equipment*

Destination	\$ Value
Bulgaria	4,818,929
Czechoslovakia	21,841,709
German Democratic Republic (East Germany)	5,768,676
Hungary	12,153,641
Latvia	9,700
Mongolian People's Republic	21,373
People's Republic of China	71,851,676
Poland	15,449,339
Romania	43,723,308
USSR	14,043,034
Multiple East European Destinations	5,730
<b>TOTAL \$ VALUE:</b>	<b>145,963,807</b>

(16.7% of total commodity export to controlled destinations)

2. *Computer Software Products* (2 approvals)—Czechoslovakia

3. *Computer Maintenance Training*—People's Republic of China

4. *Computer Software Development*—USSR

EXPORT AD. REP., *supra* note 17, at Appendix E 1-22. Exports are a significant factor in the strength of the U.S. computer industry; 1980 exports comprised 20% of the industry's sales in that year. Hamilton, *U.S. Computer Industry Avoids Economic Whirlpool*, Wash. Post, Feb. 9, 1981, Washington Business, at 3, col. 1. According to J. Fred Bucy, the leading computer firms have successfully protected their technology while making large product sales. Bucy, *Protecting 'Military' Critical Technology*, ELECTRONICS, Jan. 17, 1980, at 35.

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less without software and technical instructions.<sup>125</sup> Therefore, purchases of software are at least as important as purchases of hardware in obtaining an operating computer system and, because software is basically just information, it is an export that should be strictly controlled under the critical technologies approach.<sup>126</sup>

The Computer Network Critical Technology Expert Group (CNCTEG),<sup>127</sup> which was established to advise the DOD on the implementation of the critical technologies approach to computer hardware and software, recommended dividing the subject of software technology transfer and export into six categories for control evaluation purposes.<sup>128</sup> Focusing controls on the more active mechanisms of software technology transfer and recognizing the futility of restricting exports of software available from other sources, the CNCTEG recommended control over exchange programs, and consulting and apprenticeship arrangements as a top priority. The CNCTEG found that the most effective mechanism for preventing potential adversaries from acquiring computer technology specifically designed for military uses<sup>129</sup> is tighter controls on con-

125. Gold, Goodman, & Walker, *Software: Recommendations for an Export Control Policy*, ACM COM., April, 1980, at 199-200.

126. Review of the five questions listed in the Bucy Report for identifying export applications that should be screened carefully indicates that software export is one of the more active mechanisms of technology transfer. See note 120 *supra*.

127. For a description of the Critical Technology Expert Groups see note 72 *supra* and accompanying text.

128. The six categories are:

- A. General Assistance—All Software Function Areas
- B. Product Support Assistance—All Software Function Areas
- C. Product Shipment, Military Software—All Software Function Areas
- D. Product Shipment, Other Software—All Software Function Areas
- E. Product Shipment, Commercial Software, and Usage—Software Development and Maintenance Aids, and Applications Software
- F. Product Shipment, Commercial Software, and Usage—Widely Available Operating Systems, Network Oriented Software, Database Management Software, and User Interface Software.

Gold, Goodman, & Walker, *Software: Recommendations for an Export Control Policy*, ACM COM., April 1980, at 199, 205-07. The categories of software technology in the MCTI are organized somewhat differently:

- 3.0 Software Technology
  - 3.1 Development Environment Technology
    - 3.1.1 Software Life-Cycle Management Technology
    - 3.1.2 Software Library Data Base Technology
    - 3.1.3 Software Development Tool Technology
    - 3.1.4 Formal Methods and Tools for Developing Trusted Software Technology
  - 3.2 Operations and Maintenance Technology
    - 3.2.1 Maintenance of Large Software Product Technology
  - 3.3 Application Software Technology
    - 3.3.1 Secure Software Technology
    - 3.3.2 Large Self-Adapting Software System Technology.

45 Fed. Reg. 65,016 (1980).

129. Gold, Goodman & Walker, *Software: Recommendations for an Export Control Policy*, ACM COM., April 1980, at 199, 205-06.

puter support assistance, such as training programs, and on software developed specifically for military systems. Other CNCTEG recommendations focused on eliminating controls on exports such as widely available commercial software and commercial application packages with no military significance.<sup>130</sup> The CNCTEG thought those controls were unnecessary.<sup>131</sup>

Recognizing the special problems involved in software export, Commerce has issued interim export licensing requirements for computer software.<sup>132</sup> These interim regulations implement some of the CNCTEG recommendations by requiring detailed information on proposed software exports to aid the licensing assessments made by the Office of Export Administration.<sup>133</sup> With more information available, the Office of Export Administration's technicians can more easily identify cases where the hardware export would not be militarily significant, but where the software and associated information would transfer militarily critical technologies. The problem with these regulations is that the criteria used by the technicians for approval or denial are unchanged. Thus, the requirement for more information may in the end create a greater administrative burden without a corresponding improvement in the export process.

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130. *Id.* at 207.

131. *Id.*

132. 45 Fed. Reg. 80,485 (1980).

133. The interim regulations require the following information regarding electronic computers and related equipment:

A description of all computer software (whether under validated or general license) that will be exported for use with the equipment including:

- (a) Identification of each standard software package proposed for export, by name or other description, followed by a detailed functional description of the use of each software program.
- (b) Means by which each software program identified by (a), above, is intended to be conveyed, *i.e.*, source or object code, supporting manuals, or other material that is intended to convey information related to such programs, with a description of the scope and content of each form.
- (c) Information required by (a) and (b), above, as relates to non-standard, or customized software, intended for export.
- (d) An explanation of why software proposed for export in other than object form is required.
- (e) A description of the scope of training of persons receiving the software and/or the scope of the software maintenance that is proposed, as related to software programs identified above, or independent of actual software products intended for export.
- (f) A statement as to whether any software intended for export has been previously exported in the same form. Differences in previously exported software, *e.g.*, source and object form, supporting material, and scope or character of training, should be explained.
- (g) The relationship of each software program to the avowed end-use of the hardware equipment.

45 Fed. Reg. 80,485 (1980).

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## V. ASSESSMENT OF THE CRITICAL TECHNOLOGIES APPROACH TO LICENSING

The criterion for evaluating the critical technologies approach to export licensing is its effectiveness in meeting the conflicting goals of preserving national security and promoting trade. Both goals were explicitly stated in the EAA of 1979<sup>134</sup> and recognized in the Bucy Report.<sup>135</sup>

The critical technologies approach has numerous advantages. One frequently cited advantage is the reduction of uncertainty in export license decisions.<sup>136</sup> The critical technologies approach reduces uncertainty in two ways. First, the detailed MCTL will provide explicit guidance to potential exporters as to what can and cannot be exported. Second, the MCTL will expedite the export license approval process; the more rapidly an export license application is processed, the shorter the uncertainty period.<sup>137</sup> Greater certainty in the export license process will reduce costs to both the government and industry. In contrast to the current system, where potential exporters' applications are now denied only after going through the expensive approval process, use of the MCTL may result in exporters withdrawing their applications at the outset, or not applying at all, when denial is fairly certain.

A net reduction in the number of "active relationship" types of transfers to potential adversaries as a result of the tighter controls on information exchange, turnkey plants, and sales of manufacturing equipment with active instruction will also protect national security and decrease the uncertainty in the approval process. Control of transfers through the critical technologies approach corrects the inconsistency in previous

134. EAA of 1979, *supra* note 9, at § 2402.

135. Bucy Report, *supra* note 11.

136. *Id.* at 28.

137. The time limitations for export license application processing in the 1979 EAA have already expedited the process to a small extent. *See* EAA of 1979, *supra* note 9, at § 2409 and EXPORT AD. REP., *supra* note 17, at 12-13. The utilization of the MCTL, once it is incorporated into the CCL, should further expedite the licensing process. The present CCL is quite detailed, 15 C.F.R. § 399, but it focuses on products rather than technologies. The list focuses on product controls while DOD technicians must attempt to carry out the directive of the Secretary of Defense in his interim policy statement of 1977, which requires DOD export control review for national security purposes to focus on technologies. 1977 DOD Interim Policy Statement, *supra* note 8. This inconsistency between the product orientation of the CCL presently in use and the mandate to focus on technologies in licensing decisions increases the difficulties of the present licensing process for the DOD technicians. The MCTL will include information not in the CCL, such as the status of development of a particular technology in a country that is a potential adversary. Currently, the DOD and Commerce have been relying on a variety of sources for this information, and the time required to assemble the information on a case-by-case basis has been cited as a factor delaying licensing decisions. 1980 Senate Governmental Affairs Hearings, *supra* note 11, at 64-65 (statement of Lawrence J. Brady).



export policies, which promoted information exchanges while restricting product sales.<sup>138</sup> The importance of engineering and manufacturing know-how to the transfer of technologies is expressly recognized in the critical technologies theory.<sup>139</sup> When the MCTL has been developed and incorporated into the CCL, the list's detail and the emphasis on active technology transfer mechanisms should highlight the relationship among transfer of know-how, the protection of technological leadtime in military applications, and U.S. national security interests.<sup>140</sup> When U.S. businesses recognize what the problem areas are, a certain amount of self-policing may occur. For example, sales proposals that are currently presented only to be followed by export license denials may be more closely tailored to the export control guidelines. A U.S. company may work harder to get a foreign importer to accept product sales rather than sales of manufacturing capability and know-how.<sup>141</sup> Government employees responsible for reviewing export license applications may also be more aware of the importance of technology transfers and more readily recognize the most effective mechanisms for such transfer because of the MCTL's explicitness. Licensing decisions will then be more effective in preventing export of technologies that would be detrimental to the U.S. national security position.

Another advantage of the critical technologies approach is its bias in

138. In many areas, the dividing line between science and technology is blurred so that exchanges of scientific information, research, and personnel begin to include technology transfer. The difficulty in differentiating scientific exchanges from technological exchanges is illustrated by one of the cooperative projects the United States and the Soviet Union worked on involving the "improvement of metal cutting tool life by 3 to 8 times as a result of electron beam evaporation of titanium carbide, and titanium carbide and cobalt onto the tools." *1978 House Science & Technology Hearings*, *supra* note 36, at 7 (statement of Thomas Pickering). While metal cutting tools are not used exclusively to produce military equipment, this technology may arguably enhance military equipment production capabilities and perhaps even have future direct military applications. Nevertheless, according to Thomas Pickering, Former Assistant Secretary, Oceans and International Environmental and Scientific Affairs, Department of State, "[a]ny processes and methods that have reached the point of commercial exploitation are automatically excluded from cooperation under the agreements." *Id.* at 7. A further concern with the scientific exchanges is that, although the exchange program will stop short of a technology exchange, it may provide a potential adversary with all of the relevant information and technical capability so that all that would remain to be done would be to take the scientific information the one last step to production. Additional concerns have been voiced repeatedly that U.S. promotion of East-West scientific exchanges may be ill-advised. *1980 Senate Governmental Affairs Hearings*, *supra* note 11, at 36-43 (information supplied by Dr. William J. Perry).

139. *See* Bucy Report, *supra* note 11, at 1.

140. *See generally* Bucy Report, *supra* note 11.

141. There will be considerable difficulty in completely substituting product sales for manufacturing plant sales, as evidenced by the PRC's inclination toward acquiring technologies to become independent of the West, rather than establishing a long-term trade relationship in technological products. *See generally* *Technology Transfer to China: Hearings Before the Subcomm. on Science, Research and Technology, and the Subcomm. on Investigations and Oversight of the House Comm. on Science and Technology*, 96th Cong., 1st Sess. (1979).

favor of product sales over technology sales. This is an export strategy that can stimulate future exports and create a favorable balance of trade, whereas technology sales effect a permanent transfer of production capability, product sales retain the production capability within the exporting country, maintaining the exporter-importer relationship.<sup>142</sup> Also, national security considerations aside, many U.S. businesses could strengthen their position in the world market if they limited their exports to products. A business that exports entire factories to foreign enterprises creates its own future competitors.<sup>143</sup>

The trade promotion benefits of the critical technologies approach will also strengthen national security. To the extent that "harniess" exports are increased, U.S. industry should benefit, thus strengthening the U.S. economy.<sup>144</sup> An improved economic situation means there will be more money available for research and development, which is essential for maintaining a technological lead. Because U.S. military technology has been dependent upon commercial development of processes and equipment in recent years, commercial research and development is an important factor in future military superiority. In addition, a favorable balance of trade may stimulate military expenditures on research and development.<sup>145</sup>

Some aspects of the critical technologies approach to export controls, however, may prove detrimental to national security interests. There is concern that publication of the very detailed MCTL, which will provide potential exporters and government administrators with explicit guidance in the area of technology transfers, will also provide potential adversaries with an excellent catalog of the latest U.S. technology and even guidance on which technologies are the most promising for military use.<sup>146</sup> This concern prevented the October 1, 1980 publication of the detailed list in the *Federal Register*.<sup>147</sup> In response to this fear, however,

142. "The transfer of know-how is irreversible." Bucy Report, *supra* note 11, at 26.

143. An example of a U.S. export of a turnkey plant and associated technology to the Soviet Union that reduced the potential export business of American companies was Ford Motor Company's shipment of auto parts and technicians to teach the Ford production techniques to the Gorki workers in the early 1950's. Gersham, *Selling Them the Rope—Business and the Soviets*, COMMENTARY April 1979, reprinted in 1980 Senate Governmental Affairs Hearings, *supra* note 11, at 10.

144. See text accompanying note 142 *supra*.

145. See 1978 Senate Hearings, *supra* note 11, at 31 (statement of Dr. William J. Perry).

146. Hager Interview, *supra* note 72.

147. 45 Fed. Reg. 65,014 (1980). Although the original intention was to publish a list of technologies and goods utilizing those technologies, security problems arose in deciding how much of the detailed information should be released to the public. Therefore, the DOD decided to publish only the table of contents of the list for the October 1, 1980 deadline. *Id.* at 65,015. However, the Department of Energy published a list of energy-related militarily critical technologies including lists of associated hardware items, military and civil applications, and foreign availability. *Id.* at 65,152. The 1979 EAA requires publication in the *Federal Register* "in any appropriate form", EAA

one could argue that this is a price the United States must pay in order to maintain a free market system with a free flow of information and a knowledgeable commercial industry. Furthermore, concern regarding publication probably over-dramatizes the significance of the information contained in the MCTL; diligent intelligence work could produce much of the information anyway. In many cases, the information is available from other sources, and even where the technological developments have not been publicly released, intelligence sources may have knowledge of their existence.<sup>149</sup>

One other criticism of the critical technologies approach is that restricting only the export of technology, and not the export of goods, does not adequately protect national security. With commercial research and development in the United States far surpassing military research and development, military applications of many commercially-developed technologies are not recognized until after the commercial applications are obsolete.<sup>149</sup> By the time the military significance is recognized, the good has often already been exported. The concern over potential military application is particularly relevant when the country acquiring the technology has a planned economy that emphasizes military development over commercial development, as in the Soviet Union.<sup>150</sup> Such a country might upgrade its military capabilities with equipment and technology obsolete by U.S. commercial standards but not yet used by the U.S. military forces.<sup>151</sup>

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of 1979, *supra* note 9, at § 2404(d)(4), which the DOD interpreted to allow publication of only the table of contents to meet the deadline. Nevertheless, the MCTL that is ultimately issued must "be sufficiently specific to guide the determinations of any official exercising export licensing responsibilities under this Act." *Id.* at § 2404(d)(3).

148. Although inclusion on the MCTL would mean that exports would be restricted, the number of recent high technology thefts and illegal exports have alerted officials to the possibility that, once the information is released, a potential adversary will obtain the desired technology or equipment, legally or illegally, if necessary. A further concern is with the publication of foreign availability of the technologies and equipment on the MCTL. This reveals to our potential adversaries the exact status of U.S. intelligence information on other countries' technological advancement, which would be of particular use in their military planning. The existence of wide-spread industrial espionage has been widely acknowledged. See 1980 Senate Governmental Affairs Hearings, *supra* note 11, at 5 (statement of Sen. Sam Nunn); Gershman, *Selling Them the Rope—Business and the Soviets*, COMMENTARY, April 1979, reprinted in 1980 Senate Governmental Affairs Hearings, *supra* note 11, at 12.

149. Bucy, *Protecting Militarily Critical Technology*, ELECTRONICS, Jan. 17, 1980, at 36.

150. An example of the difference between U.S. and Soviet emphasis on technology development is that the Soviet Union's estimated expenditures on its high-energy lasers program are somewhat over \$1 billion, while the entire technology base effort of the United States Air Force is less than \$1 billion. *Technology Exports: Department of Defense Organization and Performance: Hearing Before the Subcomm. on Int'l Economic Policy and Trade of the House Comm. on Foreign Affairs*, 96th Cong., 1st Sess. 2-3 (1979) (statement of Dr. William J. Perry).

151. An example of a technology area that was not considered militarily significant until recently, although it had been exploited commercially for some time, is the area of small engine

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## VI. CONCLUSION

The critical technologies approach to export licensing represents an evolutionary change in emphasis in U.S. export policy rather than a drastic alteration of export policy for high-level technology. While the majority of export licensing cases will probably result in the same decision under the critical technologies approach as under the CCL, the borderline cases may receive closer scrutiny under the critical technologies approach. The basic uniformity of licensing decisions is illustrated by the Kama River truck plant export approval, the Dresser Industries rock drill bit plant export approval, and the Spawr laser mirrors export denial. In these cases, the use of the critical technologies approach raises new questions to be considered in deciding whether to grant the export license, but the ultimate result is often unchanged.<sup>152</sup> The value of the questions to be answered in applying the critical technologies approach is illustrated by the Kama River truck plant, where the focus on active transfer mechanisms such as the export of technology and production equipment would trigger a closer review of the export license application than that conducted in 1971. Even in high technology areas such as computer software, the critical technologies approach provides a set of criteria for making difficult export licensing decisions, although the problems of computer software export are not yet resolved.<sup>153</sup>

As a tool for protecting national security through controls on the transfer of technology, the critical technologies approach appears to be both workable and effective. Although world demand is concentrated on technologies rather than products, in those areas where the United States is the sole supplier of a technology and its associated products, potential purchasers would presumably prefer to buy the products rather than nothing. Exports of products and information that are available from foreign sources cannot be restricted under the foreign availability provisions of the EAA of 1979 "unless the President determines that the absence of export controls . . . would prove detrimental to the national security of the United States."<sup>154</sup> Moreover, the increased emphasis on coordination of international controls mandated by the EAA of 1979 and the incorporation of the critical technologies ap-

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technology. The cruise missile program transformed small engine technology into a critical technology area. *1979 House Foreign Affairs Hearings*, *supra* note 63, at 97 (statement of Dr. Ruth M. Davis).

152. See notes 94-122 *supra* and accompanying text.

153. 45 Fed. Reg. 80,484 (1980).

154. EAA of 1979, *supra* note 9, at § 2404(f).

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proach into the CoCom export control process should further increase the effectiveness of U.S. export controls.

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